



## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### **HIGHLIGHTED ARTICLES**

#### [Occurrence of demersal fishes in relation to near-bottom oxygen levels within the California current large marine ecosystem](#)

Fisheries Oceanography (2.542)

#### [Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: Arctic region](#)

Aquatic Mammals (0.702)

#### [Multinational tagging efforts illustrate regional scale of distribution and threats for East Pacific green turtles \(\*Chelonia mydas agassizii\*\)](#)

PLoS One (3.534)

### **ADDITIONAL ARTICLES**

#### [NMFS Publications](#)

#### [Intraspecific variation of the green turtle, \*Chelonia mydas\* \(Cheloniidae\), in the foraging area of Gorgona Natural National Park \(Colombian Pacific\)](#)

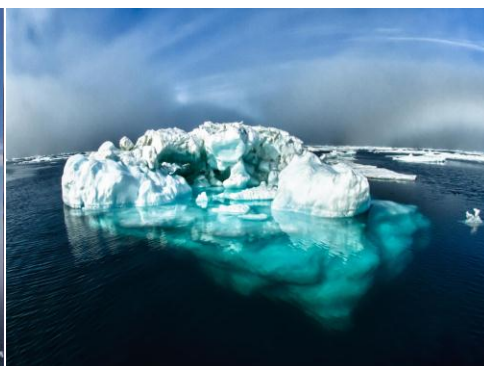
Acta Biologica Colombiana (0.112)

#### [Catch-quota balancing mechanisms in the Icelandic multi-species demersal fishery: are all species equal?](#)

Marine Policy (2.621)

#### [Salmon consumption by Kodiak brown bears \(\*Ursus arctos middendorffi\*\) with ecosystem management implications](#)

Canadian Journal of Zoology (1.346)





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### [Habitat, predation, growth, and coexistence: could interactions between juvenile red and blue king crabs limit blue king crab productivity?](#)

Journal of Experimental Marine Biology and Ecology (2.475)

### [Modeling animal movement using the Argos satellite telemetry location error ellipse](#)

Methods in Ecology and Evolution (5.322)

### [The relative reproductive success of early maturing resident Chinook salmon in a natural river system](#)

Transactions of the American Fisheries Society (1.314)

### [Are social aggregation and temporary immigration driving high rates of increase in some Southern Hemisphere humpback whale populations?](#)

Marine Biology (2.393)

### [Arctic marine mammal population status, sea ice habitat, and conservation recommendations for the 21st century](#)

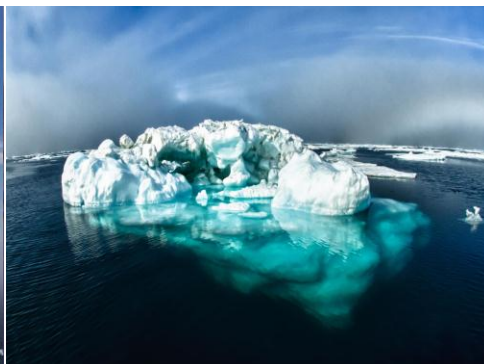
Conservation Biology (4.32)

### [Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: West Coast region](#)

Aquatic Mammals (0.702)

### [Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: Gulf of Alaska region](#)

Aquatic Mammals (0.702)





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### [Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: Aleutian Islands and Bering Sea region](#)

Aquatic Mammals (0.702)

### [How a catch-quota balancing system can go wrong: an evaluation of the species quota transformation provisions in the Icelandic multi-species demersal fishery](#)

ICES Journal of Marine Science (2.525)

### [Residence times of juvenile salmon and steelhead in off-channel tidal freshwater habitats, Columbia River, USA](#)

Canadian Journal of Fisheries and Aquatic Sciences (2.276)

### [Widespread detection of human- and ruminant origin Bacteroidales markers in subtidal waters of the Salish Sea in Washington State](#)

Journal of Water and Health (1.172)

### [Quantitative assessment of species identification in aerial transect surveys for ice-associated seals](#)

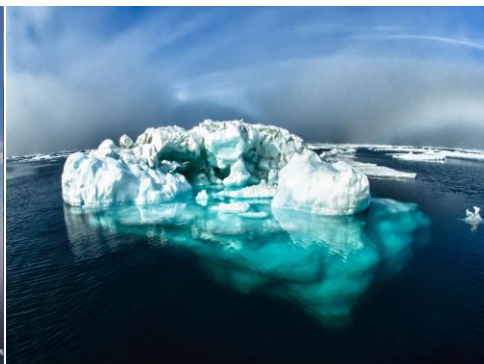
Marine Mammal Science (1.820)

### [Spatio-temporal patterns of stratification on the Northwest Atlantic](#)

Progress in Oceanography (3.986)

### [Probability of stochastic depletion: an easily interpreted diagnostic for stock assessment modeling and fisheries management](#)

ICES Techniques in Marine Environmental Sciences







## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### OAR Publications

#### [Galápagos coral reef persistence after ENSO warming across an acidification gradient](#)

Geophysical Research Letters (4.456)

### **OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS**

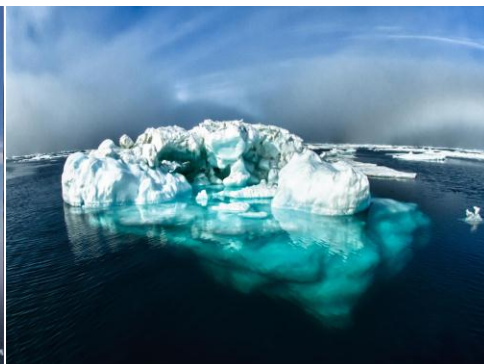
#### NOS Publications

#### [Recent Activities at the National Geodetic Survey—Part 1 of 4](#)

The American Surveyor

#### [FIG Commission 5.3 Report – Geodetic and Positioning Infrastructure](#)

International Federation of Surveyors Commission 5





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### HIGHLIGHTED ARTICLES

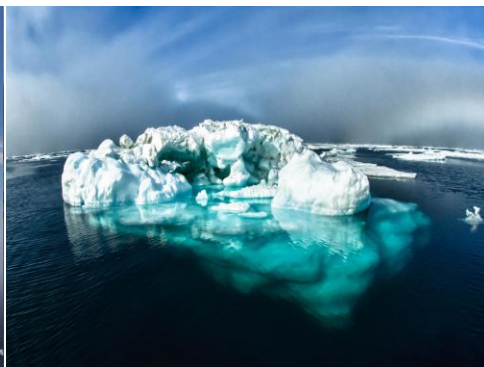
*Occurrence of demersal fishes in relation to near-bottom oxygen levels within the California current large marine ecosystem*

Fisheries Oceanography (2.542)

**A. Keller, L. Ciannelli, W. W. Wakefield, V. Simon (NMFS/NWFSC), J. A. Barth, and S. D. Pierce**

- Within the California Current large marine ecosystem, shoaling of the oxygen minimum zone (OMZ) is expected to produce complex ecosystem-level changes.
- The onshore movement of the OMZ could lead to habitat compression for species with higher oxygen requirements while perhaps allowing expansion of species tolerant of low bottom DO concentrations.
- Spotted ratfish and petrale sole were sensitive to changes in near-bottom oxygen, while greenstriped rockfish and Dover sole showed no changes in probability of occurrence in relation to changes in oxygen concentration.

Various models driven by increased greenhouse gases and higher temperatures predict a decline in oceanic dissolved oxygen (DO) as a result of greater stratification, reduced ventilation of waters below the thermocline, and decreased solubility at higher temperatures. Since spreading of low oxygen waters is currently underway and predicted to increase, understanding the impacts on higher trophic levels is essential. As part of the Northwest Fisheries Science Center's annual groundfish bottom trawl survey, the authors sampled catch across a range of near-bottom oxygen conditions extending from the upper to the lower limit of the OMZ as well as shoreward across the adjacent continental shelf along the U.S. west coast. Dissolved oxygen ranged from 0.02 to 4.25 ml l<sup>-1</sup> with 642 stations (of 1020 sampled) experiencing hypoxic conditions (DO < 1.43 ml l<sup>-1</sup>) in 2008 - 2010. Catch per unit effort (kg ha<sup>-1</sup>) and species richness (n), for demersal groundfishes and benthic invertebrates combined, exhibited significant and positive relationships with near-bottom oxygen concentration within the Eastern North Pacific along the U.S. west coast over this period. Probability of occurrence was estimated for four selected species: spotted ratfish (*Hydrolagus colliei*), petrale sole (*Eopsetta*





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

*jordani*), greenstriped rockfish (*Sebastes elongates*), and Dover sole (*Microstomus pacificus*) using a binomial Generalized Additive Model fit to presence/absence data from the 2008 to 2010 groundfish surveys. In addition to the interaction term between depth and near-bottom oxygen concentration, the models for each species included terms for position (longitude and latitude), day of the year, salinity and near-bottom water temperature.

Expected publication date: Winter 2015

### *Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: Arctic region*

Aquatic Mammals (0.702)

J.T. Clarke, **M. C. Ferguson** (NMFS/AKFSC), C. Curtice, and **J. Harrison** (NMFS/OPR)

- Biologically Important Areas (BIAs) for cetaceans were identified in the Alaskan Arctic to aid NOAA, other federal agencies, and the public in the analyses and planning that are required under multiple U.S. statutes to characterize, analyze, and minimize the impacts of anthropogenic activities on cetaceans and to achieve conservation and protection goals.
- The BIAs and associated information may be used to identify information gaps and prioritize future research and modeling efforts to better understand cetaceans, their habitat, and ecosystems.
- The BIA assessment is intended to provide the best available science to help inform regulatory and management decisions under existing authorities about some, though not all, important cetacean areas in the Alaskan Arctic.

In this assessment, the authors combined published and unpublished information to identify 16 Biologically Important Areas (BIAs) for bowhead whales, gray whales, and belugas in the US Arctic. BIAs for bowhead whales and belugas were based on high-density areas used recurrently for reproduction, feeding, and migration, documented by visual surveys (aerial, vessel and ice-based), bioacoustic monitoring, and satellite telemetry. BIAs for gray whales were based on high-density areas used recurrently for reproduction and feeding, documented primarily by aerial and vessel surveys. The geographic extent of the BIAs in the Arctic region ranged from approximately 1,500 km<sup>2</sup> to 137,000 km<sup>2</sup>. Information gaps identified during the







## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

Arctic BIA assessment process include: 1) bowhead whale use of the western Beaufort Sea in summer (e.g., feeding, migration timing, movement rates); 2) the existence or extent of a bowhead whale fall migratory corridor in the Chukchi Sea; 3) the extent and nature of beluga use of outer continental shelf and slope habitat in the Beaufort Sea; 4) the existence or location of gray whale migratory corridors in spring and fall; 5) the degree to which gray whales move between known feeding hotspots; and 6) the distribution, density, and activities of fin, humpback, minke, and killer whales and harbor porpoises in this region. To maintain their utility, the Arctic BIAs should be re-evaluated and revised, if necessary, as new information becomes available.

Expected publication date: March 2015

*Multinational tagging efforts illustrate regional scale of distribution and threats for East Pacific green turtles (Chelonia mydas agassizii)*

PLoS One (3.534)

C. E. Hart, G. S. Blanco, M. S. Coyne, C. Delgado-Trejo, B. J. Godley, **T. T. Jones** (NMFS/PIFSC), A. Resendiz, **J. A. Seminoff**, (NMFS/SWFSC), M. J. Witt, and W. J. Nichols

- This is the first collection of all known flipper tagging and satellite tracking data for the east Pacific green turtle all housed in one paper.
- It underscores the long-distance movements of green turtles and the need for multinational cooperation.

This research further describes movement patterns and distribution of East Pacific green turtles (*Chelonia mydas agassizii*) and will help determine threat levels for this species within the Eastern Pacific. In order to do this we combined published data from existing flipper tagging and early satellite tracking studies with data from an additional 12 satellite tracked green turtles (1996-2006). Three of these were tracked from their foraging grounds in the Gulf of California along the east coast of the Baja California peninsula to their breeding grounds in Michoacán (1337-2928 km). In addition, three post-nesting females were satellite tracked from Colola beach, Michoacán to their foraging grounds in southern Mexico and Central America (941.3-3020 km). A further six turtles were tracked in the Gulf of California within their foraging





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

grounds giving insights into the scale of ranging behaviour. Turtles undertaking long-distance migrations showed a tendency to follow the coastline. Turtles tracked within foraging grounds showed that foraging individuals typically ranged up to 691.6 km (maximum) from release site location. Additionally, we carried out threat analysis (using the cumulative global human impact in the Eastern Pacific) clustering pre-existing satellite tracking studies from Galapagos, Costa Rica, and data obtained from this study; this indicated that turtles foraging and nesting in Central American waters are subject to the highest anthropogenic impact. Considering that turtles from all three rookeries were found to migrate towards Central America, it is highly important to implement conservation plans in Central American coastal areas to ensure the survival of the remaining green turtles in the Eastern Pacific. Finally, by combining satellite tracking data from this and previous studies, and data of tag returns we created the best available distributional patterns for this particular sea turtle species, which emphasized that conservation measures in key areas may have positive consequences on a regional scale.

Expected publication date: Spring 2015

<http://www.plosone.org/article/fetchObject.action?uri=info:doi/10.1371/journal.pone.0116225&representation=PDF>

### ADDITIONAL ARTICLES

#### NMFS Publications

*Intraspecific variation of the green turtle, *Chelonia mydas* (Cheloniidae), in the foraging area of Gorgona Natural National Park (Colombian Pacific)*

Acta Biologica Colombiana (0.112)

L. Sampson, L. F. Payan, D. F. Amoroch, **J. A. Seminoff (NMFS/SWFSC)**, and A. Giraldo

- Green turtles at Gorgona Natural National Park come from two distinct nesting populations and have differing morphology and population status.
- Gorgona Natural National Park is an important area for green turtles and should be the focus of increased conservation efforts.

The size distribution and body condition of the two morphotypes of green turtle (*Chelonia mydas*) foraging in Gorgona Natural National Park (GNNP) in the Colombian Pacific was







## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

assessed from 2003 to 2012. Measurements of straight carapace length (SCL), curved carapace length (CCL), weight, and body condition of 1,023 turtles captured on the GNNP reefs were recorded. More black turtles ( $n = 747$ ) than yellow turtles ( $n = 276$ ) were captured, all of them juveniles. Black turtles were significantly larger and heavier than yellow turtles. The size of recruitment to the neritic zone was 40.0-49.9 cm SCL for both morphotypes, but there were more yellow than black turtles in this size class, indicating a difference in the recruitment pattern. The body condition index of yellow turtles was significantly higher than that of black turtles, which could indicate differences in resource use. Based on our results, we suggest that GNNP might function as a recruitment area for yellow turtles, which arrive at smaller sizes, and as part of a coastal migratory route for black turtles, which arrive at larger sizes and maintain residence at this location for an unknown period of time.

Expected publication date: Spring 2015

*Catch-quota balancing mechanisms in the Icelandic multi-species demersal fishery: are all species equal?*

Marine Policy (2.621)

**D. S. Holland (NMFS/NWFSC), A. E. Punt, and P. Woods**

- This is the first empirical investigation of the use of species transformation system in the Icelandic IFQ system.
- The authors determined that while this system has allowed some species total allowable catch to be exceeded repeatedly, there is no evidence that it has contributed to depletion of any species.

Maximizing profits in the joint-production scenario of multi-species fisheries is ubiquitously problematic. Individual quota systems can provide incentives for fishermen to maximize profits without exceeding allowable catches of individual species. However, less profitable but more easily caught or less productive species can often constrain the catch of more profitable species, since fishers cannot fully control or predict the species composition of their catch. Some management systems allow fishers to account for mismatches between their catches and allotted quotas using catch-quota balancing mechanisms, including quota trading, forward- or





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

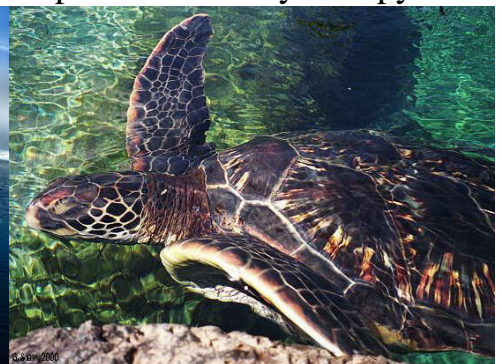
backward- transfers of quota between years, transformations of species quota into other species quota, or deemed value payments. Some of these mechanisms potentially allow for persistent fishing over allowable limits, but are employed under the assumption that variation in usage across fishers and/or years will lead to close adherence to allowable catches on average. In this study, we test this hypothesis by analyzing Icelandic landings data for 14 demersal fish species during 2001 – 2013 in relation to implemented total allowable catches, and usage of catch-quota balancing mechanisms (between-year transfers and species transformations) The results are then interpreted in the context of the catch limits recommended by the Marine Research Institute (MRI) and annual market values. Landings surpassed legal limits of total allowable catch in 27% of the cases (species by fishing year), mostly due to species transformations, but in no species was this a consistent trend. Instead, catches of some species were consistently less than legal limits, with some indications that landings were related to profitability (i.e. correlations existed with annual market value). However, landings surpassed MRI recommendations in 67% of the cases, and landings of four of the species (Atlantic wolffish, haddock, monkfish and redfish) consistently exceeded MRI recommendations. Therefore, discrepancies between scientific recommendations for catch limits and quotas selected through the political process may represent a higher risk to long-term sustainability than catch-quota balancing mechanisms. Accepted: January 2015

### *Salmon consumption by Kodiak brown bears (Ursus arctos middendorffi) with ecosystem management implications*

Canadian Journal of Zoology (1.346)

M. B. Van Daele, C. T. Robbins, B. X. Semmens, **E. J. Ward** (NMFS/NWFSC), L. J. Van Daele, and W. B. Leacock

- Stable isotopes are a useful biomarker for identifying what animals eat.
- This study applies a novel model that also incorporates the accumulation of mercury to estimate intake of salmon by Kodiak brown bears.
- Results show that the inclusion of other tracers / biomarkers (e.g. contaminant data) could be a useful path for identifying what animals eat, and the trophic niches they occupy.





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

The ecological role of large predators in North America continues to spark heated public debate. Although brown bears and the salmon they feed on have declined in many areas, the Kodiak archipelago is famous for large brown bears and abundant salmon. Salmon have generally been managed for maximum sustained yield in a fisheries sense, but those levels may be well below what is necessary for maximum ecosystem productivity. Consequently, the Authors used stable isotopes and mercury accumulated in hair to estimate intake of salmon by Kodiak brown bears (*Ursus arctos middendorffi* Merriam, 1896). Salmon intake increased from subadult males ( $592 \pm 325$  kg/bear/yr) to adult males ( $2788 \pm 1929$ ) and from subadult females ( $566 \pm 360$  kg/bear/yr) to adult females ( $1364 \pm 1261$ ). Intake within each group increased  $62 \pm 23\%$  as salmon escapement increased from  $\sim 1500$  to  $\sim 14,000$  kg/bear/yr. The estimated population of 2300 subadult and adult bears consumed  $3.77 \pm 0.16$  million kg of salmon annually, a mass equal to 6% of the combined escapement and commercial harvest. Although bears consume a small portion of the total mass of adult salmon, perpetuation of dense populations of large bears requires ecosystem-based management of the meat resources and environments that produce such bears.

Accepted: January 2015

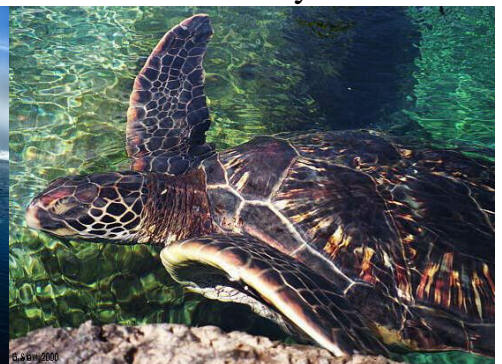
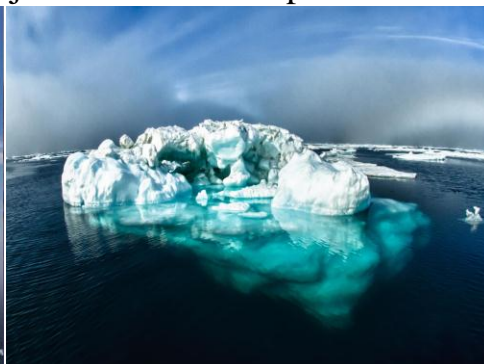
*Habitat, predation, growth, and coexistence: could interactions between juvenile red and blue king crabs limit blue king crab productivity?*

Journal of Experimental Marine Biology and Ecology (2.475)

**W. C. Long, S. B. Van Sant, and J. A. Haaga (NMFS/AKFSC)**

- Results presented suggest that juvenile red king crabs have an advantage over blue king crabs which could lower productivity of the Pribilof Islands blue king crab stock since the former became dominant in that system.

Since the 1970s, dominance of the shallow water Pribilof Islands king crab populations has shifted from blue king crab (*Paralithodes platypus*) to red king crab (*Paralithodes camtschaticus*), potentially influenced by interactions at the juvenile stage. In laboratory experiments, we determined whether habitat and temperature could mediate competitive and predatory interactions between juveniles of both species. We examined how density and







## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

predator presence affect habitat choice by red and blue king crabs. Further experiments determined how temperature and habitat affect predation by year-1 red king crab on year-0 blue king crab. Finally, long-term interaction experiments examined how habitat and density affected growth, survival, and intra-guild interactions between red and blue king crab. Red king crabs had a greater affinity for complex habitat than blue king crabs and the presence of predators increased preference for complex habitat for both species. Predation on year-0 blue king crabs by year-1 red king crabs was lower in complex habitats and at colder temperatures. When reared alone, red king crab survival was higher at low densities and in complex habitats. When reared with blue king crab, survival of red king crab was higher in complex habitats and in the presence of blue king crab. Blue king crab survival was substantially lower in the presence of red king crabs regardless of habitat. In both rearing experiments, differences in changes in crab size appeared to be driven by mortality rates and size selective predation. This demonstrates that interactions between juvenile red and blue king crabs are primarily driven by intra-guild predation and not competition for resources. These results suggest that juvenile red king crabs have an advantage over blue king crabs which could lower productivity of the Pribilof Islands blue king crab stock since the former became dominant in that system.

Expected publication date: March 2015

Early online: <http://www.sciencedirect.com/science/article/pii/S0022098114003335>

*Modeling animal movement using the Argos satellite telemetry location error ellipse*  
Methods in Ecology and Evolution (5.322)

**B. T. McClintock, J. M. London, M. F. Cameron, and P. L. Boveng (NMFS/AKFSC)**

- We support the Argos recommendation that practitioners wishing to more properly account for location measurement error utilize the error ellipse in analyses.
- However, the continued presence of outliers using the new algorithm suggests practitioners should consider using a fat-tailed distribution derived from the error ellipse (e.g., bivariate  $t$ -distribution) or filtering extreme outliers during data preprocessing.

The Argos satellite telemetry system is popular for studying the movement and space use of marine animals. Using a new Kalman filtering algorithm, Argos now provides locations and





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

estimated error ellipses associated with each satellite fix, but to our knowledge, the location error ellipse has yet to be incorporated into analyses of animal movement or space use. We first present an observation model utilizing the Argos error ellipse, and then demonstrate how this observation model can be combined with a simple three-dimensional movement model in a state-space formulation to infer activity budgets and movement characteristics from location and dive data of two species of seal, the arctic bearded seal (*Erignathus barbatus*) and the Hawaiian monk seal (*Monachus schauinslandi*). These example datasets are of variable quality and represent species that differ in both space use and latitudinal range relative to the polar orbits of Argos instruments. We also compare the results from our error ellipse model with those from an approximate (isotropic) error circle model. We found the error circle to be a crude approximation of the actual anisotropic error ellipse for the higher-quality bearded seal data, but inferences from the lower-quality Hawaiian monk seal data were more robust to the choice of observation model. In both examples, we found the theoretical bivariate normal distribution corresponding to the error ellipse often failed to adequately explain the most extreme location outliers. In practice, we suspect the inferential consequences of using traditional isotropic location quality classes or other crude approximations in lieu of the error ellipse will be largely case dependent. We support the Argos recommendation that practitioners wishing to more properly account for location measurement error utilize the error ellipse in analyses. However, the continued presence of outliers using the new algorithm suggests practitioners should consider using a fat-tailed distribution derived from the error ellipse (e.g., bivariate  $t$ -distribution) or filtering extreme outliers during data preprocessing.

Early online: 18 December 2014

<http://onlinelibrary.wiley.com/doi/10.1111/2041-210X.12311/full>

*The relative reproductive success of early maturing resident Chinook salmon in a natural river system*

Transactions of the American Fisheries Society (1.314)

**M. J. Ford (NMFS/NWFSC), T. N. Pearsons, and A. R. Murdoch**





## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

- This is the first study demonstrating that early-maturing, non-migratory male Chinook salmon are mating successfully in the wild.
- Indicates that hatchery fish that remain in the stream after release and do not migrate need to be considered when evaluating effects of hatchery programs.

Hatchery propagation of spring Chinook salmon has been shown to greatly increase the proportion of males maturing as mini-jacks (age 2) or micro-jacks (age 1) compared to what occurs in wild populations. Little is known, however, about the reproductive success of early maturing males when they spawn in the wild. A captive broodstock program for spring Chinook salmon in the White River, a tributary of the Wenatchee River, has a high rate of early male maturity. In this study, the authors used genetic parentage analysis to evaluate the reproductive success of anadromous males compared to what we infer to be early maturing resident hatchery males spawning in the White River. Based on samples of >1000 juvenile offspring per year and a nearly complete census of the potential anadromous parents, they found that in the years 2006 to 2009, 26% to 46% of the progeny did not have a male parent in the anadromous sample. In contrast, 0% - 25% of the progeny did not have a sampled female parent. Using grandparentage analysis, they eliminated wild resident fish as a likely source of missing male parents, and concluded that they are most likely to be early maturing resident fish released from the captive broodstock program. The reproductive success of these unsampled resident males was significantly lower than that of the anadromous males, and the typical mating pattern was for a female to produce about 2/3 of her offspring with one or two anadromous males and the remaining 1/3 with a larger number (up to a dozen or more) of apparently resident males. This study is the first to present evidence of successful reproduction of early maturing, resident hatchery Chinook salmon in the wild. The conservation implications of this finding are complex, and will depend upon the genetic basis of early maturity and its causes in hatchery settings.

Expected publication date: Spring 2015







## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

*Are social aggregation and temporary immigration driving high rates of increase in some Southern Hemisphere humpback whale populations?*

Marine Biology (2.393)

**P.J. Clapham and A. Zerbini (NMFS/AKFSC)**

- This paper introduces the possibility that an apparent failure of humpback whales to recover may instead be due to socially mediated distribution shifts.
- The authors warn that failing to account for social ecology of a species in population modeling may lead to misinterpretation of results.

Humpback whales (*Megaptera novaeangliae*) in the Southern Hemisphere were heavily exploited by commercial whaling. Today, their recovery is variable: humpbacks remains surprisingly scarce in some formerly populous areas (e.g. New Zealand, Fiji), while in other regions (such as eastern Australia) they appear to be rebounding at or even above the maximum plausible rate of annual increase. Here, the authors propose that this phenomenon cannot be explained solely in demographic terms. Through simulation, they test the hypothesis that reported high rates of increase represent a combination of true intrinsic growth rates and temporary immigration, driven by a strong tendency to aggregate for mating. They introduce the idea that overexploitation diminished density at major breeding grounds such that these were no longer viable; then, during subsequent population recovery, a critical mass was attained in certain areas which drew in whales that formerly bred elsewhere. The simulations show that, to maintain high increase rates, the contribution to that rate by temporary immigration from a second, “source” population would have to represent a larger and larger proportion of the source stock and would require relatively large (but quite plausible) intrinsic rates of increase for each population. In the modeling scenarios, the demand for immigrants would eventually exceed the supply and exhaust the source population, but the simulations demonstrated that high increase rates can be sustained over periods of more than 20 years. This hypothesis, if correct, would not only explain excessively high rates of increase in current “hotspots” such as eastern Australia, but would also imply that formerly important areas (e.g. Fiji) host few whales today not necessarily because of a failure to recover, but because the species’ mating system leads the





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

whales concerned to migrate to higher-density breeding grounds elsewhere. Overall, they caution that assessments of depleted animal populations that do not consider the social behavior of a species are missing a potentially vital component of the picture.

Early Online: 22 January 2015

<http://link.springer.com/article/10.1007%2Fs00227-015-2610-3>

### *Arctic marine mammal population status, sea ice habitat, and conservation recommendations for the 21st century*

Conservation Biology (4.32)

K. L. Laidre, H. Stern, K. M. Kovacs, L. Lowry, S. E. Moore, E. V. Regehr, S. H. Ferguson, Ø. Wiig, **P. Boveng, R. P. Angliss (NMFS/AKFSC)**, E. W. Born, D. Litovka, L. Quakenbush, C. Lydersen, D. Vongraven, and F. Ugarte

- The paper summarizes the available data on abundance and trends in abundance for each species of marine mammal in the high Arctic; trends are unknown or unreliable for nearly all populations and subpopulations.
- The paper makes recommendations for Arctic marine mammal conservation including maintenance of effective co-management of harvested populations, incorporating variability caused by climate change into predictive models and management plans for Arctic marine mammals, maintaining or implementing new programs for monitoring of Arctic marine mammals, improving our understanding of cumulative effects of multiple stressors on species, and acknowledging that current legislation may not fully address the threats currently faced by Arctic marine mammals.

Arctic marine mammals (AMMs) are considered icons of climate change, largely because of their close association with sea ice. However, neither a circumpolar assessment of AMM status nor a standardized metric of sea ice habitat change is available. We summarize available data on abundance and trends for each AMM species and recognized subpopulation. We also examine species diversity, the extent of human use, and temporal trends in sea ice habitat for 12 regions of the Arctic by calculating the dates of spring sea ice retreat and fall sea ice advance using satellite data (1979-2013). Estimates of AMM abundance vary greatly in quality and few





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

studies are long enough for trend analysis. Of the AMM subpopulations, 78% (61 of 78) are legally harvested for subsistence purposes. Changes in sea ice phenology have been profound with earlier retreat and later advance in all regions except the Bering Sea. From 1979-2013, the duration of the summer (i.e., reduced-ice) period increased by 5 to 10 weeks over most of the Arctic, and by >20 weeks in the Barents Sea. In light of generally poor data, the importance of human use, and forecasted environmental changes in the 21<sup>st</sup> century, we make the following recommendations for effective AMM conservation: 1) maintain and improve co-management by local, federal, and international partners; 2) recognize spatial and temporal variability in AMM subpopulation response to climate change; 3) implement monitoring programs with clear goals; 4) mitigate cumulative impacts of increased human activity, and 5) recognize the limits of current protected species legislation.

Accepted: December 2014

### *Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: West Coast region*

Aquatic Mammals (0.702)

J. Calambokidis, G. Steiger, C. Curtice, **J. Harrison (NMFS/OPR)**, **M. C. Ferguson (NMFS/AKFSC)**, E. Becker, **M. DeAngelis (NMFS/WCRO)**, and S. M. Van Parijs

- Biologically Important Areas for cetaceans were identified in waters off the U.S. West Coast to aid NOAA, other federal agencies, and the public in the analyses and planning to characterize, analyze, and minimize the impacts of anthropogenic activities on cetaceans and to achieve conservation and protection goals.
- The assessment is intended to provide the best available science to help inform regulatory and management decisions under existing authorities about some, though not all, important cetacean areas in the West Coast region.

In this review, we combine existing published and unpublished information along with expert judgment to identify and support the delineation of 28 Biologically Important Areas (BIAs) in US waters along the west coast for blue whales, gray whales, humpback whales and harbor porpoises. BIAs for blue whales and humpback whales are based on high concentration areas of







## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

feeding animals observed from small boat surveys, ship surveys, and opportunistic sources. These BIAs compare favorably to broader habitat-based density models. BIAs for gray whales are based on their migratory corridor as they transit between primary feeding areas located in northern latitudes and breeding areas off Mexico. Additional gray whale BIAs are defined for the primary feeding areas of a smaller resident population. Two small and resident population BIAs defined for harbor porpoises located off California encompass the populations' primary areas of use. The size of the individual BIAs ranged from approximately 171 km<sup>2</sup> to 138,000 km<sup>2</sup>. The BIAs for feeding blue, gray, and humpback whales represent relatively small portions of the overall west coast area (<5%) but encompass a large majority (77-89%) of the thousands of sightings documented and evaluated for each species. We also evaluate and discuss potential feeding BIAs for fin whales, but none are delineated due to limited or conflicting information. The intent of identifying BIAs is to synthesize existing biological information in a transparent format that is easily accessible to scientists, managers, policymakers, and the public for use during the planning and design phase of anthropogenic activities for which US statutes require the characterization and minimization of impacts on marine mammals. To maintain their utility, West Coast BIAs should be re-evaluated and revised, if necessary, as new information becomes available.

Expected publication date: March 2015

*Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: Gulf of Alaska region*

Aquatic Mammals (0.702)

**Ferguson, M. C. (NMFS/AKFSC), C. Curtice, and J. Harrison (NMFS/OPR)**

- Biologically Important Areas (BIAs) for cetaceans were identified in the Gulf of Alaska to aid NOAA, other federal agencies, and the public in the analyses and planning that are required under multiple U.S. statutes to characterize, analyze, and minimize the impacts of anthropogenic activities on cetaceans and to achieve conservation and protection goals.





## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

- The BIAs and associated information may be used to identify information gaps and prioritize future research and modeling efforts to better understand cetaceans, their habitat, and ecosystems.
- The BIA assessment is intended to provide the best available science to help inform regulatory and management decisions under existing authorities about some, though not all, important cetacean areas in the Gulf of Alaska.

The authors integrated existing published and unpublished information to delineate Biologically Important Areas (BIAs) for fin, gray, North Pacific right, and humpback whales, and belugas in US waters of the Gulf of Alaska. BIAs are delineated for feeding, migratory corridors, and small resident populations. Supporting evidence for these BIAs came from aerial, land-based and vessel-based surveys; satellite tagging data; passive acoustic monitoring; traditional ecological knowledge; photo- and genetic-identification data; and whaling data, including catch and sighting locations and stomach contents; prey studies; and anecdotal information from fishermen. The geographic extent of the BIAs in this region ranged from approximately 1,000 km<sup>2</sup> to 177,000 km<sup>2</sup>. Information gaps identified during this assessment include: 1) reproductive areas for fin, gray, and North Pacific right whales; 2) detailed information on the migration routes of all species; 3) detailed information on the migratory timing of all species except humpback whales; and 4) cetacean distribution, density, and behavior in US Gulf of Alaska waters off the continental shelf. To maintain their utility, these BIAs should be re-evaluated and revised, if necessary, as new information becomes available.

Expected publication date: March 2015

*Biologically Important Areas for cetaceans within the US Exclusive Economic Zone: Aleutian Islands and Bering Sea region*

Aquatic Mammals (0.702)

**M. C. Ferguson (NMFS/AKFSC), J. M. Waite (NMFS/AKFSC), C. Curtice, J. T. Clarke, and J. Harrison (NMFS/OPR)**

- Biologically Important Areas (BIAs) for cetaceans were identified in the Aleutian Islands and Bering Sea to aid NOAA, other federal agencies, and the public in the analyses and





## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

planning that are required under multiple U.S. statutes to characterize, analyze, and minimize the impacts of anthropogenic activities on cetaceans and to achieve conservation and protection goals.

- The BIAs and associated information may be used to identify information gaps and prioritize future research and modeling efforts to better understand cetaceans, their habitat, and ecosystems.
- The BIA assessment is intended to provide the best available science to help inform regulatory and management decisions under existing authorities about some, though not all, important cetacean areas in the Aleutian Islands and Bering Sea.

The authors integrated existing published and unpublished information to delineate Biologically Important Areas (BIAs) for bowhead, fin, gray, North Pacific right, and humpback whales and belugas in US waters of the Aleutian Islands and Bering Sea. Supporting evidence for these BIAs came from aerial, land-based and vessel-based surveys; satellite tagging data; passive acoustic monitoring; traditional ecological knowledge; photo- and genetic-identification data; and whaling data, including catch and sighting locations and stomach contents. The geographic extent of the BIAs in this region ranged from approximately 1,200 km<sup>2</sup> to 373,000 km<sup>2</sup>.

Information gaps identified during this assessment include: 1) reproductive areas for all species; 2) detailed information on the migration routes and timing of all species; and 3) cetacean distribution, density, and behavior in US Bering Sea waters off the continental shelf. To maintain their utility, these BIAs should be re-evaluated and revised, if necessary, as new information becomes available.

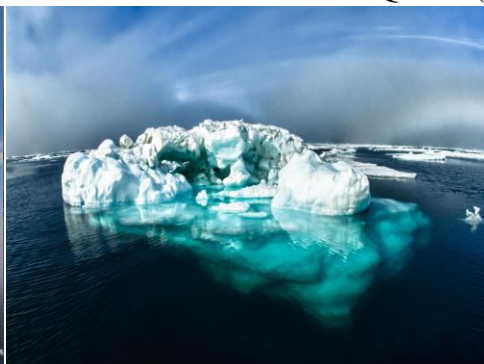
Expected publication date: March 2015

*How a catch-quota balancing system can go wrong: an evaluation of the species quota transformation provisions in the Icelandic multi-species demersal fishery*

ICES Journal of Marine Science (2.525)

P. Woods, **D. S. Holland** (NMFS/NWFSC), A. E. Punt, and G. Marteinsdottir

- This study analyzes the potential negative consequences of a species transformation system in a multispecies Individual Transferable Quota (ITQ) system.







## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

- Illustrates which types of stocks are at greatest risk and why, and demonstrates that transformation may limit the ability of managers to move from an MSY to and MEY management strategy.

Implementation of single-species catch limits in multi-species fisheries is problematic because it may incentivize discarding behavior when quotas for some species limit catch of jointly caught species. Since discarding may lead to economic inefficiency and bias stock assessments, mechanisms that reduce incentives to discard can be beneficial to a multi-species management system. However, if these mechanisms also increase flexibility in how quotas can be used by fishers, they may be detrimental in the long term. Increased risk of stock depletion occurs if they enable catch to persistently exceed the total allowable catch (TAC). This study uses a bioeconomic model to analyze potential negative consequences of the species quota transformation provisions in the Icelandic individual transferable quota (ITQ) system. These provisions allow quota of one species to be transformed into quota of another species at specified rates related to relative value. We explore how these provisions may affect long-term sustainability of individual species and profitability of the fishery as a whole. The system reduces the degree that the TAC of any particular species constrains the catch of other species. However, it also allows catches of some species to exceed TACs, possibly leading to stock depletion. We focus on the extreme case of perfect targeting (i.e., full control of catch composition) to increase intuition on the potential for adverse effects of this system. Various combinations of species profitability are examined to determine attributes of species that lead to greater vulnerability, as well as interactions in species utilization. Consequences of changing harvest control rules are explored, and information needed to monitor for unintended consequences of such a system in practice are discussed. Although the species transformation system is designed to increase economic efficiency, it can lead to depletion in some cases, which can make it difficult or impossible to achieve maximum economic yield (MEY). Expected publication date: Summer 2015





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### *Residence times of juvenile salmon and steelhead in off-channel tidal freshwater habitats, Columbia River, USA*

Canadian Journal of Fisheries and Aquatic Sciences (2.276)

G. E. Johnson, G. R. Ploskey, N. K. Sather, and **D. J. Teel (NMFS/NWFSC)**

- This study is the first to estimate residence times for juvenile salmonids specifically in off-channel areas of tidal freshwater and, most importantly, residence times for Chinook salmon expressing a life history of overwintering in tidal freshwater.
- The findings support restoration of shallow off-channel habitats in tidal freshwater portions of the Columbia River.

This study documented two life history strategies for juvenile salmonids as expressed in off-channel tidal freshwater habitats of the Columbia River: 1) active migrations by upper river Chinook salmon and steelhead during the primary spring and summer migration periods, and 2) overwinter rearing in tidal freshwater habitats by coho salmon and naturally produced Chinook salmon mostly from lower river sources. During spring/summer 2007-2008, acoustic-tagged fish originating above Bonneville Dam (rkm 234) had short residence times in off-channel areas (rkm 192-203): median 2.5 and 2.6 h for yearling (mean lengths 134 and 158 mm) and 3.0 and 3.4 h for subyearling (104 and 116 mm) Chinook salmon, and 2.5 h for yearling steelhead (215 mm). The percentage of fish in off-channel areas out of the total in the main- and off-channels areas was highest for yearling Chinook salmon (8.1 and 9.3% for 2007 and 2008, respectively), and lowest for steelhead (4.0% for 2008) and subyearling Chinook salmon (3.6 and 6.1% for 2007 and 2008, respectively). In late January and early February 2010, 2011, and 2012, the Authors captured and tagged yearling Chinook and coho salmon occupying off-channel tidal freshwater habitats. Median residence times in off-channel areas were 11.6-25.5 d for juvenile Chinook (106, 115, and 118 mm, respectively by year) and 11.2 d for coho salmon (116 mm). This study is the first to estimate residence times for juvenile salmonids specifically in off-channel areas of tidal freshwater and, most importantly, residence times for Chinook salmon expressing a life history of overwintering in tidal freshwater. The findings support restoration of shallow off-channel habitats in tidal freshwater portions of the Columbia River.





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

Accepted: December 2014

*Widespread detection of human- and ruminant origin Bacteroidales markers in subtidal waters of the Salish Sea in Washington State*

Journal of Water and Health

Z. Oyafuso, **A. E. Baxter**, **J. E. Hall**, **S. M. Naman**, **C. E. Greene**, and **L. D. Rhodes**  
(NMFS/NWFSC)

- This research shows how molecular tools applied for tracking sources of fecal contamination can also be used as an indicator for larger ecosystem water quality.

Rising populations around coastal systems are increasing the threats to marine water quality. To assess anthropogenic fecal influence, subtidal waters were examined monthly for human- and ruminant-sourced Bacteroidales markers at 80 sites across six oceanographic basins of the Salish Sea (Washington State) from April through October, 2011. In the basin containing cities with individual populations >190,000, >50% of sites were positive for the human marker, while in the basin with high densities of dairy and cattle operations, ~30% of sites were positive for the ruminant marker. Marker prevalence was elevated in spring (April and May) and fall (October) and reduced during summer (June through September), corresponding with seasonal precipitation. By logistic regression, the odds of human marker detection increased with percentage of adjacent catchment impervious surface, dissolved nitrate concentration, and abundance of low nucleic acid bacteria, but decreased with salinity and chlorophyll fluorescence. The odds of ruminant marker detection increased with dissolved ammonium concentration, mean flow rate for the nearest river, and adjacent shoreline length. These relationships are consistent with terrestrial to marine water flow as a transport mechanism. Thus, Bacteroidales markers traditionally used for identifying nearby sources can be used for assessing anthropogenic fecal inputs to regional marine ecosystems.

Expected publication date: Summer 2015







## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### *Quantitative assessment of species identification in aerial transect surveys for ice-associated seals*

Marine Mammal Science (1.820)

**B. McClintock, E. Moreland, J. London, S. Dahle, G. Brady, E. Richmond, K. Yano, and P. Boveng (NMFS/AKFSC)**

- We generally found ice seal species and age class misidentification occurred at relatively low levels, but only 83% of spotted seals tended to be correctly identified (with 11% mistaken as ribbon seals).
- Our findings add to the growing body of evidence that species misidentification is pervasive in passive sampling of animal populations.
- Even low levels of misidentification have been demonstrated to induce substantial biases in estimators of species distribution and abundance, and it is important that statistical models account for such errors.

Technological advances have facilitated collection of vast quantities of photographic data from aerial surveys of marine mammals. However, when it is difficult to distinguish species from a distance, reliable identification from aerial images can often be challenging. This is the case for ice-associated seals, species for which global climate change has motivated intensive monitoring efforts in recent years. We assess species and age class identification from aerial images of four ice seal species (bearded seals, *Erignathus barbatus*; ribbon seals, *Histiophoca fasciata*; ringed seals, *Pusa hispida*; spotted seals, *Phoca largha*) in the Bering Sea. We also investigate the specific phenomenological and behavioral traits commonly associated with species identification and observer confidence. We generally found species and age class misidentification occurred at relatively low levels, but only 83% of spotted seals tended to be correctly identified (with 11% mistaken as ribbon seals). We also found certain traits were strong predictors for observed species, age class, or observer confidence. Our findings add to the growing body of evidence that species misidentification is pervasive in passive sampling of animal populations. Even low levels of misidentification have been demonstrated to induce





## NOAA SCIENTIFIC PUBLICATIONS REPORT

### FEBRUARY 4, 2014

substantial biases in estimators of species distribution and abundance, and it is important that statistical models account for such errors.

Expected publication date: 31 January 2015

#### *Spatio-temporal patterns of stratification on the Northwest Atlantic*

Progress in Oceanography (3.986)

Y. Li, **P. S. Fratantoni**, C. Chen, **J. A. Hare**, Y. Sun, R. C. Beardsley, and R. Ji  
(NMFS/NEFSC)

- This paper provides the first high-resolution spatially explicit stratification climatology for the Northwest Atlantic Continental Shelf.
- The authors examine the interplay between thermal and haline controls on stratification and identify spatial and temporal patterns across scales not resolved by previous studies.
- Two key metrics are proposed for indexing the timing of stratification onset and breakdown across the continental shelf and a new (gamma) regime diagram is introduced that is useful for characterizing the temporal evolution of stratification and its controls.

A spatially explicit stratification climatology is constructed for the Northwest Atlantic continental shelf using daily averaged hydrographic fields from a 33-year high-resolution, data-assimilated reanalysis dataset. The high-resolution climatology reveals considerable spatio-temporal heterogeneity in seasonal variability with strong interplay between thermal and haline processes. Regional differences in the magnitude and phasing of the seasonal cycle feature earlier development/breakdown in the Middle Atlantic Bight (MAB) and larger peaks on the shelf than in the Gulf of Maine (GoM). The relative contribution of the thermal and haline components to the overall stratification is quantified using a novel diagram composed of two key ratios. The first relates the vertical temperature gradient to the vertical salinity gradient, and the second relates the thermal expansion coefficient to the haline contraction coefficient. Two distinct regimes are identified: the MAB region is thermally-dominated through a larger portion of the year, whereas the Nova Scotian Shelf and the eastern GoM have a tendency towards haline control during the year. The timing of peak stratification and the beginning/end of thermally-positive and thermally-dominant states are examined. Their spatial distributions





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

indicate a prominent latitudinal shift and regionality, having implications for the seasonal cycle of ecosystem dynamics and its interannual variability.

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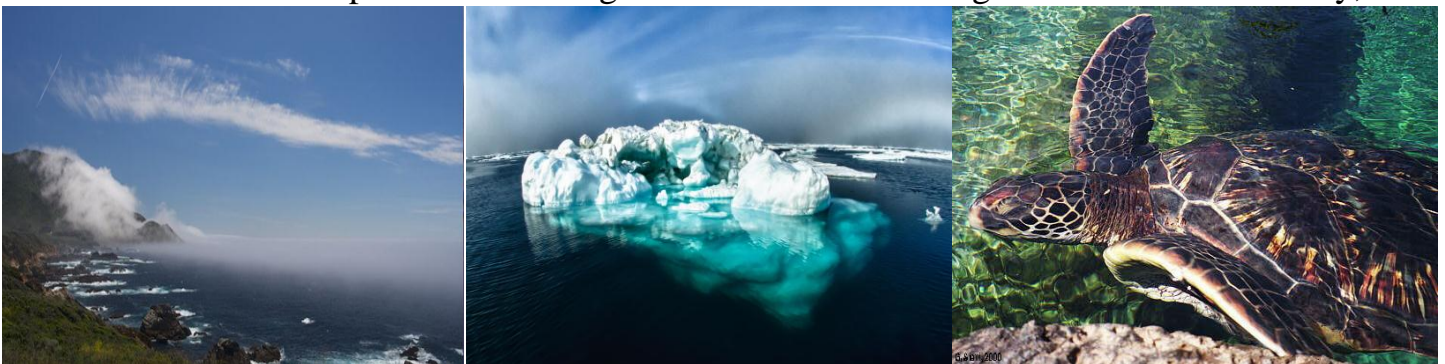
*Probability of stochastic depletion: an easily interpreted diagnostic for stock assessment modeling and fisheries management*

ICES Techniques in Marine Environmental Sciences

**J. T. Thorson (NMFS/NWFSC), O. Jensen, and R. Hilborn**

- The authors use recent research regarding the magnitude of variation in survival rates for larval and early juvenile fishes to answer the question: what magnitude of variation in population size is expected for unfished populations, or ideally managed populations?
- They show that unfished populations have (on average) variation of nearly 30% of their unfished population size, and that this value rises to nearly 35% for ideally fished populations.
- These values can serve as a benchmark when interpreting populations that are over or under management targets.

Marine fish populations have high variation in cohort strength, and the production of juveniles (recruitment) may have persistent positive or negative residuals (autocorrelation) after accounting for spawning biomass. Autocorrelated recruitment will occur whenever average recruitment levels change between oceanographic regimes, but may also indicate environmental and biological variation on shorter time-scales. Here, we use estimates of recruitment variability and autocorrelation to simulate the stationary distribution of spawning biomass for 100 real-world stocks when unfished, fished at FMSY, or fished following a 40-10 control rule where fishing mortality decreases as a function of spawning biomass. Results show that unfished stocks have spawning biomass (SB) below its deterministic value ( $SB_0$ ) 58% of the time, and below  $0.5SB_0$  5% of the time on average across all stocks. Similarly, stocks fished at the level producing deterministic maximum sustainable yield (FMSY) are below its deterministic prediction of spawning biomass ( $SB_{MSY}$ ) 60% of the time and below  $0.5SB_{MSY}$  8% of the time. These probabilities are greater for stocks with high recruitment variability,







## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

positive autocorrelation, and high natural mortality, and these traits are associated with clupeids and scombrids. An elevated probability of stochastic depletion implies an increasing frequency that managers must implement a rebuilding plan, so we conclude by suggesting that fisheries scientists routinely calculate these probabilities during stock assessments as a decision-support tool for fisheries managers.

Accepted: January 2015

<http://icesjms.oxfordjournals.org/content/72/2/428.abstract?etoc>

### OAR Publications

*Galápagos coral reef persistence after ENSO warming across an acidification gradient*  
Geophysical Research Letters (4.456)

**D. P. Manzello, I. C. Enochs, A. Bruckner, P. G. Renaud, G. Kolodziej, D. A. Budd, R. Carlton (OAR/AOML), and P. W. Glynn**

- Elevated levels of nutrients have the potential to exacerbate acidification in coral reef ecosystems. Increased nutrients are associated with lower density coral skeleton, leading to increased bioerosion of corals, a process already.
- This paper lays out evidence for the link between thermal stress, ocean acidification and coral reef resiliency which has been a key question in the scientific community.

Anthropogenic CO<sub>2</sub> is causing warming and ocean acidification. Coral reefs are being severely impacted, yet confusion lingers regarding how reefs will respond to these stressors over this century. Since the 1982–1983 El Niño–Southern Oscillation warming event, the persistence of reefs around the Galápagos Islands has differed across an acidification gradient. Reefs disappeared where pH < 8.0 and aragonite saturation state ( $\Omega_{\text{arag}}$ ) ≤ 3 and have not recovered, whereas one reef has persisted where pH > 8.0 and  $\Omega_{\text{arag}}$  > 3. Where upwelling is greatest, calcification by massive Porites is higher than predicted by a published relationship with temperature despite high CO<sub>2</sub>, possibly due to elevated nutrients. However, skeletal P/Ca, a proxy for phosphate exposure, negatively correlates with density (R = 0.822, p < 0.0001). We propose that elevated nutrients have the potential to exacerbate acidification by depressing coral skeletal densities and further increasing bioerosion already accelerated by low pH.

Available online: <http://onlinelibrary.wiley.com/doi/10.1002/2014GL062501/abstract>





## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

### **OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS**

#### NOS Publications

#### *Recent Activities at the National Geodetic Survey—Part 1 of 4*

The American Surveyor

**D. Smith, G. Mader, and G. Sella (NOS/NGS)**

- Guiding all of the National Geodetic Survey (NGS) activities is the Ten-Year Strategic Plan. The most recent version was released in 2013 and provides a road map of critical activities from 2013 through 2023.
- The most significant element of that plan is the replacement of the North American Datum of 1983 (NAD 83) and the North American Vertical Datum of 1988 (NAVD 88) in 2022. Coincident with these, and in coordination with NOAA's Center for Operational Products and Services (CO-OPS) and its parallel agencies in Canada, the replacement of International Great Lakes Datum (IGLD 85) will also occur.

Historically, NGS has codified the direction of the agency into long-term plans, with the intent to highlight future directions for the agency based on stakeholder feedback, scientific progress and available resources. Encompassing a complete gravity survey of the United States (the Gravity for the Redefinition of the American Vertical Datum, or GRAV-D Project), the replacement for NAVD 88 will be a GNSS- and GEOID-based datum, developed in three regions: first, North and Central America (pole to equator, covering Alaska, Hawaii, CONUS, Greenland, Canada, Mexico, Central America and the Caribbean); second, American Samoa; and third the region encompassing Guam and the Commonwealth of the Northern Mariana Islands (CNMI). The primary method of defining and accessing the datum will be through GNSS technology, not passive control, and the known biases and tilts in NAVD 88 will be removed in order to align the geoid with data from the GRAV-D project and satellites, such as GRACE. The replacements for NAD 83(2011, PA11 and MA11) will remove the current nongeocentricity in those three frames, and will align with International Terrestrial Reference Frame (ITRF) at the epoch of their release, though they will contain a plate-fixed component which will allow them to drift away from ITRF. The current "residual rotations" in NAD 83(2011) will be removed at the definitional level so that the plate-fixed nature of the new







## NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014

frames will be maintainable. The new plan isn't all about the new datums, however. Many of the activities mentioned [in the article] are also a direct outcome of the new plan. For full details, the plan may be read online at:

[http://www.ngs.noaa.gov/web/news/Ten\\_Year\\_Plan\\_2013-2023.pdf](http://www.ngs.noaa.gov/web/news/Ten_Year_Plan_2013-2023.pdf)

Published: 2 January 2015

### *FIG Commission 5.3 Report – Geodetic and Positioning Infrastructure*

International Federation of Surveyors Commission 5

#### **N. D. Weston (NOS/NGS)**

- Dr. Neil Weston represented the International Federation of Surveyors at the XIII International Congress on Surveying, Mapping, Geodesy and Geomatics, in San Jose, Costa Rica (September 19-21, 2014). He presented the keynote address titled Coastal Intelligence for Improving Positioning, Expanding Commerce and Coastal Marine Transportation.
- Dr. Neil Weston attended the IAG Commission 1 Symposium - Reference Frames for Applications in Geosciences (REFAG). During the symposium, Drs. Craymer, from the Canadian Geodetic Survey, and Weston from the National Geodetic Survey, presented a talk on Regional Reference Frames for North America - Current Status and Future Plans of Regional Sub-Commission 1.3c.

As most of us know, the Earth has an irregular surface and is quite difficult to model. Surveyors and engineers will continue to need accurate positions and other geospatial data for a wide variety of applications. The International Federation of Surveyors, Commission 5 continues to hold workshops, symposiums and scientific meetings around the world to facilitate the exchange of knowledge in surveying, navigation, gravity and geoid modeling, GIS/LIS, CORS, physical modeling, remote sensing and monitoring. Working Group 5.3 - Geodetic and Positioning Infrastructure plays a key role within Commission 5 by providing expertise on Global Navigation Satellite Systems and how these “tools” have revolutionized the way engineering, surveying, and remote sensing is conducted today. From September 19-21, 2014, Dr. Neil Weston represented the International Federation of Surveyors at the XIII International







## **NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 4, 2014**

Congress on Surveying, Mapping, Geodesy and Geomatics, in San Jose, Costa Rica. He presented the key note address titled Coastal Intelligence for Improving Positioning, Expanding Commerce and Coastal Marine Transportation. Over 400 people attended the talk which focused on the infrastructure to facilitate marine and land based transportation systems. During October 11-18, 2014 Dr. Weston also attended the IAG Commission 1 Symposium - Reference Frames for Applications in Geosciences (REFAG). He is the co-chair for the International Association of Geodesy (IAG), sub-Commission 1.3c on Regional Reference Frames for North America. During the symposium, Drs. Craymer, from the Canadian Geodetic Survey, and Weston from the National Geodetic Survey, presented a talk on Regional Reference Frames for North America - Current Status and Future Plans of Regional Sub-Commission 1.3c. The focus was to provide international focus and cooperation for issues involving the horizontal, vertical, and three-dimensional geodetic networks of North America, including Greenland, Mexico, and the Caribbean.

Accepted: 11 January 2015

